

Supplementary Materials:

Figure S1. The images of L-MWFs before (left) and after(right) the pretreatment.



Figure S2. The supernatant gradually turned red at pH was 10.00 (left) and 12.00(right).



S1. Testing methods:

Conductivity and pH test: After the test probe of the multi-parameter analyzer was washed with deionized water for three times, inserted into the middle position of the water sample to be measured, when the data was stable and reading. Each water sample was measured three times and averaged.

SV₃₀-ratio test: Volume test method was adopted. The cylinder used in the experiment was graduated, and stood for 30min after demulsification. The cement was stratified, and the sludge scale and solution scale were read directly in the bucket. SV₃₀-ratio (%) was calculated according to equation (1).

COD_{Cr} test: Filter the water sample with 0.45 μ m membrane. Diluted the water sample to a certain concentration according to the detection range. 2.00mL diluted water sample, 0.75ml potassium dichromated solution, 2.25ml sulphuric acid-silver sulphate solution and 0.10g mercury sulphate were into the digestion tube successively. After full shaking and mixing, put the digestion tube into the digestion instrument for digestion for 120min at 150°C. After cooling, the water quality analyzer DR2000 was used to read, and the COD_{Cr} of the water sample was obtained after conversion. Each water sample was measured three times and averaged.

Transmittance test: Firstly, the water sample was tested three times under the full wavelength, and the highest light transmittance wavelength was 500nm. Filtered the water sample to be measured with 0.45µm membrane. Opened the UV-visible spectrophotometer, preheated for 20min, selected the transmittance test mode, adjusted the wavelength to 500nm, poured the water sample into the colorimeter, inserted the corresponding groove after reading. Each water sample was measured three times and averaged.

Zeta potential and particle size test: Filtered the water sample with 0.45µm membrane. After the nano-particle tester preheated, the water sample to be measured by pouring into the potential measuring tank and inserting into the groove. Inputted parameters, directed reading after measurement. Each water sample was measured three times and averaged.